DOCUMENT RESUME

ED 288 854 SP 029 633

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TITLE New Dimensions in Research on Class Size and Academic Achievement.
INSTITUTION National Center on Effective Secondary Schools, Madison, WI.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE Sep 87
GRANT G-008690007
NOTE 24p.
PUB TYPE Information Analyses (070)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Classroom Environment; *Class Size; *Educational Research; Elementary Secondary Education; Instructional Effectiveness; *Teacher Student Ratio; Teacher Student Relationship

ABSTRACT

This synthesis of research on class size provides an overview of the development of class size research, a summary of findings on class size and achievement, and a discussion of factors that interact with class size to influence academic achievment. It is concluded that while the overall research picture offers ample evidence of achievement gains associated with smaller class size, this relationship is complicated by mediating process variables. It is suggested that class size is but one of several factors that, in combination, affect student achievement. Efforts to reduce class size should begin with analyses of how, within a given school or subject area, the manipulation of class size might improve student-teacher interaction. Fifty-five references and a 20-item supplementary bibliography are appended. (CB)

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NEW DIMENSIONS IN RESEARCH ON CLASS SIZE AND ACADEMIC ACHIEVEMENT

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September, 1987

I am grateful to Fred Newmann, William Smith, Anne Lockwood, Lynn Lunde, and Marshall Smith for assistance in the preparation of this paper.

This research synthesis was prepared at the National Center on Effective Secondary Schools, Wisconsin Center for Education Research, School of Education, University of Wisconsin-Madison, which is supported by a grant from the Office of Educational Research and Improvement, U.S. Dept. of Education (Grant No. G-008690007). The opinions expressed in this publication are those of the author and do not necessarily reflect the views of this agency or the U.S. Department of Education.

EXECUTIVE SUMMARY

SYNTHESIS ON NEW DIMENSIONS IN CLASS SIZE RESEARCH

Seventy-five years of research on the effect of class size on academic achievement, has, until recently, produced confusing results, but in the last decade improved research methodology and changing conceptual approaches have brought more clarity to the issue. The degree to which this research can be assumed to be directly relevant to high schools is somewhat uncertain, owing to a dependence on data drawn from both elementary and secondary schools. However, related teacher load research which focuses more directly on secondary schools supports the overall conclusion of class size research: smaller classes produce conditions necessary, though not sufficient, for successful teaching and learning.

This synthesis of research on class size provides an overview of the development of class size research, a summary of findings on class size and achievement, and a discussion of factors which interact with class size to influence academic achievement.

Research on class size began by focusing on only a few isolated organizational factors, but it has evolved to a broader view of the school as a cultural environment best understood through analysis of several interacting variables. Since the influence of class size alone has been difficult to isolate, some researchers have argued that class size in and of itself is not a crucial factor. They assert that attention to class size has obscured other, more important factors which affect student learning and achievement, such as students' economic and family background, teachers' characteristics, instructional goals and strategies, instructional materials, grade level, subject area, and the contributions of paraprofessionals in the classroom. Class size influences the frequency and quality of student-teacher interaction and therefore has an indirect relationship to academic achievement.

Many researchers directly address the class size question, agreeing on the following conclusions: 1) Smaller classes result in increased student-teacher contact. 2) Reductions in class size to less than 20 students without changes in instructional methods cannot guarantee improved academic achievement. 3) No single class size is optimal for all grade levels and subjects. 4) Smaller classes appear to result in greater achievement gains for students with lower academic ability and those who are economically or socially disadvantaged. 5) Classroom management improves in smaller classes. 6) Smaller classes result in higher teacher morale and reduced stress. 7) Individualization is more likely to occur in smaller classes. 8) class size reductions alone do not necessarily lead to adoption of dramatically different instructional methods. 9) Class size appears to have more influence on student attitudes, attention, interest, and motivation than on academic achievement. 10) Smaller classes are beneficial for children at the primary level, particularly in math and reading. 11) Very small classes of five or fewer students produce considerably higher achievement.

Reductions in class size alone do not necessarily result in improved achievement when instructional methods do not change. In fact, studies of the impact of class size reduction on teacher attitudes and behavior has spawned research on the more general issues of teacher stress and teacher work load, including not only class size, but number of classes taught per day, number of instructional and supervisory demands placed on teachers, the clarity-ambiguity of their role and the kind of support they receive. This research places the class size issue in perspective by relating it to specific teacher and student behavior patterns associated with effective classrooms.

To unify research on the workload issue, some researchers have focused specifically on "teacher load" -- defined simply as the total number of students taught per day. Teacher load affects teacher morale, which in turn has an impact on the way in which teachers respond to students which, in turn, influences student achievement. Class size is one important aspect of teacher load, but teacher load is probably a more powerful variable than class size alone. Thus, it is important to consider research on teacher load and teacher stress which points to negative student outcomes when teachers are overburdened and which further indicates that positive staff morale and school social climate can have a beneficial effect on student attitudes and learning.

Role ambiguity contributes to excessive levels of teacher stress, while clarity of task and role definition improves teacher satisfaction and effectiveness. Secondary teachers are usually isolated from their peers and lack a collegial atmosphere in which to discuss their work. This deprives them of professional and social support for coping with stressful demands of teaching. They rely on their students for confirmation of success in their role, but reinforcement from students alone is often not sufficient to keep morale high.

Uninterrupted on-task teaching increases the likelihood of higher student achievement, and professional opinion stresses the importance of sustained time for preparation and feedback from peers. But literature on teacher stress has documented the lack of time for uninterrupted teaching, preparation, meetings with peers, and breaks from work. Outside the teacher stress literature, studies of teacher workload place less emphasis on time limitations, focusing instead on the number and types of tasks required.

Further research on the class size question should consider the organizational structure of high schools, as well as the nature of high school student populations, subject areas, teacher characteristics, and work processes. The traditional organizational structure of high schools tends to inhibit the sort of rescheduling that could lead to reductions in class size and a more optimal teacher work life. Reorganization must be guided, however, by a vision of the type of classroom interaction most likely to promote learning.

Since class size is but one of several factors which in combination affect student achievement, efforts to reduce class size should begin with analysis of how, within a given school or subject area, manipulation of class size could improve student-teacher interaction.

INTRODUCTION

Since the beginning of this century, literally hundreds of research studies have examined the effect of class size on academic achievement. Until recently, the general findings have been inconclusive. Studies reporting a positive relationship between small classes and academic achievement well outnumber those supporting the efficacy of large classes, but lack of consensus on this issue has led to the use of contradictory findings to support arguments on all sides of the issue. As a result, discussion of class size reduction, an expensive reform strategy, has become confused. Where public expenditure for class size reduction is mandated, policy should reflect current thinking in the field and the most accurate interpretation of research findings.

For educators and policymakers attempting to generate reforms in secondary education, the research picture is particularly ill-defined. The bulk of studies which address the class size question have mixed data collected in elementary and secondary schools, and many of the most well-known studies have drawn exclusively on elementary school sources (Note 1). Thus, the degree to which general findings of class size meta-analyses and traditional reviews can be assumed to be directly relevant to high school situations is somewhat uncertain. On the other hand, teacher load research which has focused on the secondary school appears to reflect an overall conclusion of class size research in the last decade: namely, that smaller classes produce conditions necessary, though not sufficient, for successful teaching and learning.

This conclusion has emerged in part as a result of improved research methodology applied to the class size question, and as a result of changes in the types of questions presently being studied. In the effective schools literature and research on staff working conditions, we see a shift away from investigation of isolated organizational factors to a view of the school as a cultural environment best understood through analysis of several interacting variables. This paradigm places class size in a new context as one of a set of interacting components in the school environment. The purpose of this synthesis is (1) to provide an overview of the development of class size research; (2) to offer a summary set of findings on class size and achievement, and (3) to identify factors interacting with class size that have a direct impact on academic achievement and student engagement in secondary schools.

METHODOLOGICAL DEBATE

Methodological problems associated with class size research have made it difficult for educators to turn to the research community for guidance in establishing optimal class size limits for various school settings. The problems are well-documented in reviews by Albritton (1984), LaFleur (1975), Robinson and Wittebols (1986), and Ryan and Greenfield (1975). They emphasize the lack of consistency in definitions of "large" and "small" classes, the use of diverse and questionable measures of achievement, and the inadequate design of earlier studies. The only variable consistently controlled in the majority of studies before 1975 was student ability as measured by IQ and/or standardized achievement tests.

Despite methodological improvements, isolation of the class size variable continues to present a substantial challenge to investigators. Some authors have argued class size in itself is not a crucial factor; attention to class size has obscured other, more important factors affecting student learning. It is well accepted that student achievement is only partially affected by class size, and that other critical factors include students' economic and family background, teachers' characteristics, instructional goals and strategies, instructional materials, grade level, subject area, and the contributions of paraprofessionals in the classroom. Thus, the relationship between class size and student achievement may be viewed as indirect and, according to some researchers, important insofar as it affects the frequency and quality of teacher interaction with students. To understand the scope of methodological problems associated with class size research and proposals aimed at resolving these difficulties, recent advances in statistical techniques and their application within the new "school culture" paradigm must be taken into consideration. Spady's (1976) review of major school effects studies criticized the dominant standard of linear regression analysis for its failure to detect a threshold effect identifying class size levels that have significant impact on student learning. He urged the use of cross-tabular analysis of regressions to explore threshold and interaction effects to gain a more accurate picture of the relationships. Somewhat different approaches have been taken by Robinson and Wittebols (1986) in a recent related cluster analysis of class size research and by Glass and Smith (1978) in a meta-analysis of research examining the relationship between class size and student achievement.

META-ANALYSIS OF CLASS SIZE EFFECT

Evidence of a threshold effect for class size was revealed in research by Glass and Smith (1978) using a method they developed for integrating data across studies. The results of a meta-analysis of about 80 controlled studies of class size and achievement showed that as class size increases, achievement decreases (Note 2). For example, achievement differed six percentile points between classes of 20 and 40, with more remarkable gains in classes of 15 or fewer students. Glass and Smith (1978) reported achievement differences over 10 percentile ranks in comparisons of groups of 10 and 20 students. Interestingly, the class size effect appeared stronger in well-designed studies. Although previous class size research showing no achievement advantages associated with small as opposed to large classes rarely included classes under 12 students (Glass, McGaw, & Smith, 1981), the unpredicted appearance of this threshold aroused much debate in the research community (Note 3). While still unresolved, proponents of meta-analytic class size studies stress the fact that small classes (less than 20 students) may be effective primarily because they facilitate other instructional modifications and changes in teacher/student attitudes and behavior which result in improved academic achievement.

CLUSTER ANALYSIS OF CLASS SIZE EFFECT

Recently, Robinson and Wittebols (1986) completed a cluster analysis of the research to determine class size effect on specific subject areas, instructional practices and other factors. This approach, which targets and

groups results of individual studies into clusters of related research findings, produces generalizations within a narrower scope. According to these researchers, meta-analysis tends to blur distinctions between variables and sacrifice strong positive correlations in favor of weaker relationships in the data which are of no practical value in decision-making. By focusing on specific problems and issues through isolation of the interaction between class size and relevant achievement factors, cluster analysis provides more useful information about research findings that directly relate to areas of concern in evaluating high school class size policy.

GENERAL FINDINGS

Despite disagreement over the accuracy and usefulness of various approaches to synthesis of research on class size, this author found wide agreement among researchers on the following general findings:

(1) Smaller classes result in increased student-teacher contact.

(2) Reductions in class size to less than 20 students without changes in instructional methods cannot guarantee improved academic achievement.

(3) No single class size is optimal for all grade levels and subjects.

(4) Smaller classes appear to result in greater achievement gains for students with lower academic ability and those who are economically or socially disadvantaged.

(5) Classroom management improves in smaller classes.

(6) Smaller classes result in higher teacher morale and reduced stress.

(7) Individualization is more likely to occur in smaller classes.

(8) Class size reductions alone do not necessarily lead to adoption of dramatically different instructional methods (Note 4).

(9) Class size appears to have more influence on student attitudes, attention, interest, and motivation than on academic achievement.

(10) Smaller classes are beneficial for children at the primary level, particularly in math and reading.

(11) Very small classes of five or fewer students produce considerably higher achievement (Note 5).

INTERACTION BETWEEN CLASS SIZE AND PROCESS VARIABLES

Current research reflects recognition that reductions in class size do not necessarily result in improved achievement levels when instructional methods remain the same. It appears that a trend has developed toward comparison of learning outcomes in different group sizes using a set of varying instructional strategies. As early as 1975, LaFleur, Sumner, and Witton reported the introduction of team teaching, flexible modular scheduling, non-gradedness, and differentiated staffing had altered traditional notions of "class size." Although research continues to be extremely limited on the relationship between class size and specific subject matter achievement, the impact of instructional design and subject taught has become a major factor in recent studies (Smith, 1986). For instance, Hillocks (1986) recently completed a meta-analysis of research on the teaching of composition which shows that instruction emphasizing peer group problem-solving activities is five times more powerful than traditional whole-class lecture methods. The previous tendency to study class size effects

isolated from process-type variables such as instructional methods, teacher behavior/ expectations, and teacher workload is changing. Increasingly we find studies of the effect of class size and a mediating process variable on achievement or another outcome measure. This type of result has led to statements such as the following by Smith (1986, p. 2): "Class size, when combined with mode of instruction, is a powerful determinant of learning."

Partly in response to this research, inservice training in small-group and interactive instructional practices is now seen as an essential component in class size reduction projects (Note 6); and the impact of class size reduction on teacher attitudes, behavior, and workload has itself become a subject of research interest.

It is widely reported that parents and students generally favor smaller classes and teachers overwhelmingly prefer them. This preference may be directly related to the importance teachers place on individual interactions with students. Because reductions in class size lead to increases in teacher contact with individual students, teachers are likely to view smaller classes as more conducive to improved learning situations and more personally satisfying teaching conditions. Research indicates teacher contact time is strongly related to student achievement (Cahen, Filby, McCutcheon, & Kyle, 1983; Rosenshine, 1979) and that high quality and frequent student-teacher interaction is essential to group problem-solving and other learning activities designed to stimulate higher order thinking. A recent study by Tobin (1987) suggests that duration in classroom question-response patterns is also a crucial factor in more complex learning activities. He found that increasing wait-time, the pause duration between utterances, over a 3-second threshold in class discussion produces higher levels of cognitive processing and learning gains. This can most easily be accomplished in smaller classes. Because classroom management is more difficult in large classes, the risks associated with long thinking wait-time are too high for teachers to accept.

Since research also suggests that low morale and high anxiety among teachers affect not only their performance but that of their students, and that the heavy workload of some secondary teachers contributes to excessive stress levels, interest in reducing class size has become an increasingly important political and educational issue. In the face of increasing evidence in favor of reducing class size and the high cost associated with such changes, schools are seeking other organizational means of creating small-class conditions.

SHIFTING FOCUS OF RESEARCH

Because of the costs associated with dramatic reductions in class size, along with unresolved research design problems, research on the "class size question" has diminished, but other related issues are receiving more attention, especially (a) teacher load, defined as the total number of students taught per day, (b) the effectiveness of various grouping arrangements, and (c) the effectiveness of instructional techniques when used with various sized groups. Of these, teacher load research offers insight into the effect of overall student numbers on specific teacher and student behavior patterns that are associated with effective classrooms.

TEACHER LOAD, TEACHER STRESS, AND STUDENT ACHIEVEMENT

Although little direct evidence documents the effect of number of students taught per day on academic achievement in high schools, several observers (Sizer, 1984; Smith, 1986) claim that teacher load influences teacher morale and has a dramatic effect on the ability of teachers to respond to individual students. This, in turn, affects student achievement. Teacher morale is undoubtedly affected by many variables, but the number of students taught both per day and within classes probably exert significant impact. Their impact can be conceptualized in relation to teacher stress, as in Figure 1 which summarizes various factors identified in the following discussion.

Insert Figure 1

TEACHER STRESS RESEARCH

Several components of teacher stress research are relevant to considerations of class size and student achievement. These relate primarily to questions of workload and the effects of job-related stress on teacher behavior and student learning (Note 7). Studies suggest that teacher anxiety may be detrimental to both teachers themselves and students. In a review of the literature, Goodman (1980) reports that despite the limited research in this area, evidence suggests that high levels of teacher stress may be associated with several negative student outcomes: (1) high student anxiety levels, (2) lowered student achievement levels, (3) lowered school morale, (4) increased negative feelings among students toward teachers, and (5) reduced community support. Conversely, research reviewed by Miller (1981) indicates staff morale and school social climate can have a positive effect on student attitudes and learning.

High levels of teacher stress, which over time may result in extreme feelings of depersonalization and physical/emotional exhaustion ("burnout") are strongly associated with a work overload factor (Friesen & Williams, 1985; Mykletun, 1984; Bacharach, Bauer, & Conley, 1986), role strain resulting from difficulties in fulfilling role obligations (Hawley & Rosenholtz, 1984; Beasley, Myette, & Serna, 1983), as well as role ambiguity (Bacharach et al., 1986; Schwab & Iwanicki, 1982), and insufficient collegial relations (Friesen & Williams, 1985). Definite trends are discernable in available studies and reviews; however, the data base remains relatively small and is compromised by methodological limitations. For instance, there has been little consistency in measures of stress, quality of life, and other indicators (Beasley et al., 1983). In addition, there is conceptual confusion on teacher stress and teacher burnout; for example, Farber (1984) contends that burnout is not merely the result of accumulated stress but unremitting stress.

Role strain resulting from a perceived inability to meet work obligations was found to be the best predictor of excessive teacher stress in the Friesen and Williams study (1985). However, this factor is closely associated with the workload factor since lack of time available to meet role obligations is a critical dimension of role strain. High levels of role ambiguity, or lack of

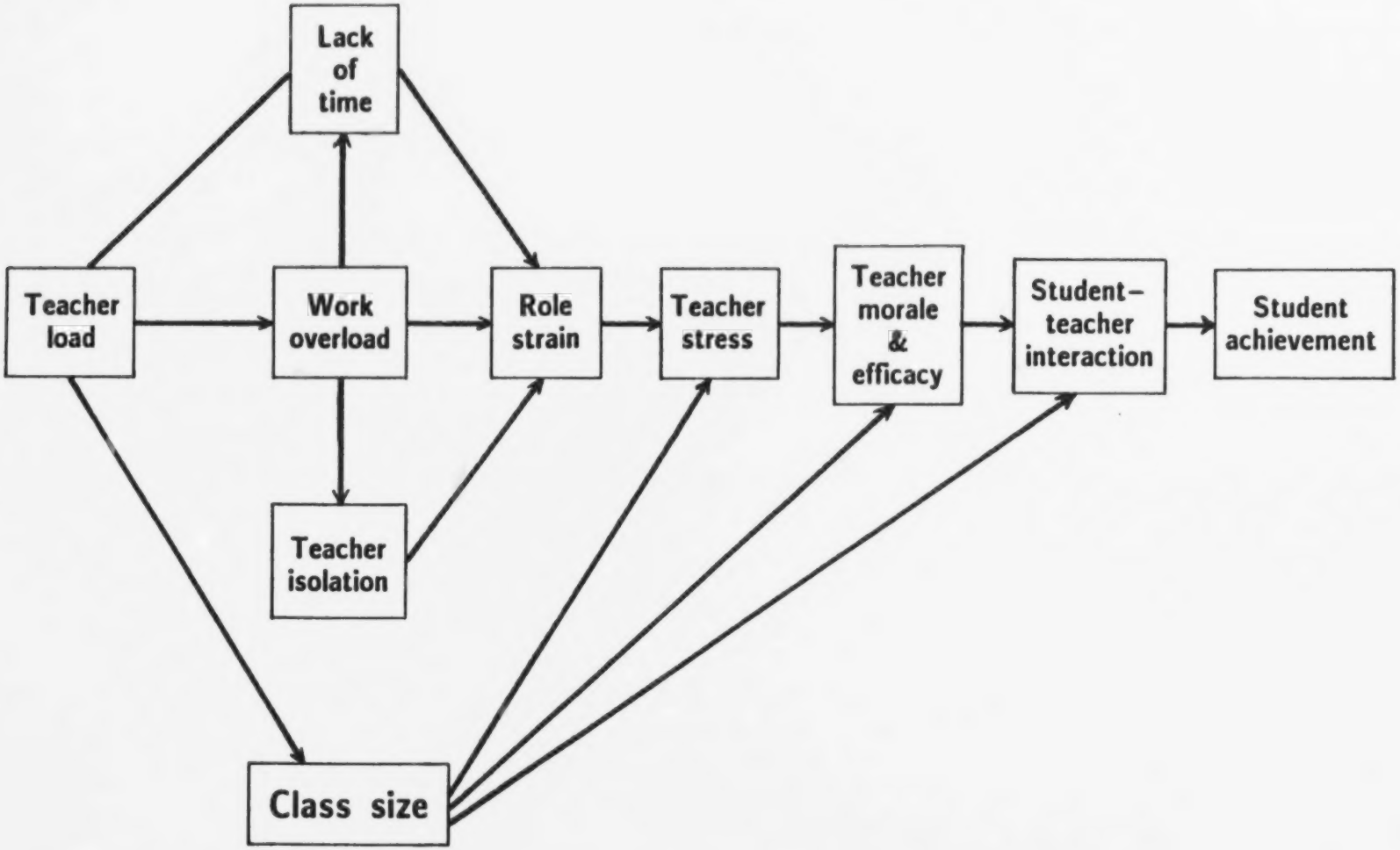

Figure 1. A Model of the Influence of Class Size on Student Achievement.

understanding of rights, responsibilities, and preferred method of performance, contribute to teacher stress levels and reduce teacher effectiveness (Hawley & Rosenholtz, 1984) (Note 8). Since teacher efficacy is positively related to student achievement (Denham & Michael, 1981; McLaughlin & Marsh, 1978; Ashton & Webb, 1986), organizational strategies to reduce role ambiguity are likely to improve student achievement. Although rigidly defined roles and ritualized school rules result in higher levels of teacher anxiety (Miskel, Fevurly, & Stewart, 1979) and reduce teacher effectiveness by threatening teacher autonomy in areas of professional judgment (Coates & Thoreson, 1976), clarity of task and role definition improves teacher satisfaction and effectiveness. Consensus among teachers within schools on teaching roles and professional success would conceivably reduce role ambiguity, but this is hard to achieve, because teachers are isolated from their colleagues for extended periods during the day, and informal conversations between teachers are usually not task-related (Lortie, 1975).

Studies reported by Mykletun (1984) and Farber (1984) cite social support as an important variable for resistance against psychosocial stressors, underscoring the need for collegiality, interaction with other adults, and inservice or other professional contacts. In the absence of sufficient collegial relations, it appears that teachers rely on their students for social support and confirmation of success in their role (Mykletun, 1984). Feiman-Nemser and Floden (1986) and Mitchell, Ortiz, and Mitchell (1982) conclude teachers are primarily rewarded by their interactions with students.

STUDENT-TEACHER INTERACTION AND ACHIEVEMENT

In addition to having an impact on teacher satisfaction and classroom stress levels, student-teacher interactions affect student achievement. Rosenshine (1979) and Stallings (1980) have found the number of behavioral sanctions made by teachers during the course of classroom instruction correlates negatively with student achievement. Interruptions in the flow of teaching for classroom or school management tasks constitute a major hindrance to student learning. That is, uninterrupted on task teaching increases the likelihood of higher student achievement (Rutter, Maughn, Mortimore, & Ouston, 1979). Responding to evidence that class size reductions result in improved classroom management and increased student-teacher contact time, one of the most successful and transferable elementary class size reduction projects, the Oak Park Plan, has enhanced these features of class size reduction (1:15) by assuring a full morning of instruction with no outside interruption (Mueller, 1985).

WORKLOAD AND TEACHER LOAD

Discussions of workload in teacher stress studies emphasize the lack of time for uninterrupted teaching, preparation, meetings with peers, and breaks from work (Friesen & Williams, 1985). Studies of teacher workload outside the teacher stress literature place less emphasis on time limitations, focusing instead on the number and types of tasks required. Consideration of the number of classes, number of preparations, subjects taught outside teacher specialty, student evaluation, and non-teaching responsibilities such as

supervision of extracurricular activities and school facilities, inservice, and other professional activities have been included in workload research. While some researchers continue to assess the impact of this wide range of professional responsibilities, there has been increasing attention to "teacher load" to unify research on the workload issue. Teacher load is defined simply as the total number of students taught per day.

While reductions in class size improve student-teacher interaction within the classroom, this variable alone fails to address the effect of the workload of secondary English teachers in evaluating student compositions. Assuming it takes 20 minutes to mark all the errors in spelling, punctuation, and syntax, and comment on content and organization in a typical weekly composition, a high school teacher with 150 students will spend 50 hours per week evaluating compositions. Since the typical teacher workweek includes 25 hours of instructional time and additional time allocated for preparation and non-teaching tasks, the workload level for a composition teacher with 150 students is over 80 hours per week: In 1977, 45% of California secondary school English teachers had loads of more than 150 students (Bamburg, 1977). In a national survey conducted the same year by Applebee (1978), responses indicated 25% of the secondary school English teachers met six classes per day, with 26 to 30 students per class, resulting in loads of up to 180 students per day. While the number of students per day is a very crude estimate of teacher workload, it does provide some indication of the time required of teachers of composition. Since lack of time-on-task available to complete professional obligations is a predictor of negative teacher stress (Friesan & Williams, 1985; Beasley et al., 1983), some districts have moved toward reductions in teacher load (Mueller, 1985; Stinette, 1986).

CONCLUSION

If research is ultimately to guide school policy on class size and teacher load, further research should take into account the nature of high school student populations, subject areas, teacher characteristics, organizational structure, and work processes. For example, the high degree of departmentalization is one way in which the traditional organization of high schools inhibits rescheduling innovations that could lead to reductions in class size and teacher load. Rescheduling arrangements may include dual-certified specialists in reduced size, core classes; or students meeting in class groups less frequently than 4-5 times per week. But the assumption that education must be delivered to groups of 30 students by one teacher in 50-minute periods meeting several days per week is firmly established. While some experiments have successfully altered this pattern, the organization of teacher and student work does not generally favor such reforms.

Fortunately, some approaches to secondary school reform recognize the structural determinants of teacher stress. There is growing realization, for example, that rigid departmental boundaries and norms of individual teacher autonomy do not necessarily protect teachers from excessive demands on their time and professional commitment. If working conditions change to yield greater collegial and collaborative contact among faculty and increased teacher participation in decisions that affect the overall school climate--not only the activities that occur within their own classrooms--teachers and administrators

may be more effective in modifying the workload. But this must be guided by a vision of the type of classroom interaction most likely to promote learning. For example, where high levels of student-teacher interaction are essential for group problem-solving exercises, cooperative learning activities, or Socratic dialogue, class size must necessarily be small; if teachers are to respond thoughtfully to students' written words, they must be responsible for fewer total students. If teachers are to work carefully on curriculum development or careful analysis of their own teaching, their supervision and disciplinary duties must be reduced.

While the overall research picture offers ample evidence of achievement gains associated with smaller class size, this relationship is complicated by mediating process variables. That is, class size is but one of several factors which, in combination, affect student achievement. Thus efforts to reduce class size should begin with analysis of how, within a given school or subject area, the manipulation of class size might improve student-teacher interaction, in part through reduction of teacher stress. Realizing that teacher-student interaction is a function of several variables beyond class size, especially teacher load, changing class size should be approached through concomitant changes related to teacher load.

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NOTES

1. In Ryan and Greenfield's review (1975), 50% of the 43 studies examined class size effect in secondary schools; 30% of these studies dealt exclusively with high schools. LaFleur (1974) reviewed 25 studies: 33% included data from secondary schools, but only 12% were high school studies, while 40% cut across all grade levels. In both reviews, about half the studies included high school data. Robinson and Wittebols (1986) examined 100 studies of class size, involving K-12 classes of five or more students: 20 date from 1950 to 1977 and 80 from 1978 to 1985. Fifty-five of these studies measure the effect of class size on student achievement. These studies and 89 additional general studies were analyzed in 3 clusters: K-3, 4-8, and 9-12. A total of 22 studies were included in the 9-12 research, with 3 including data from earlier grades.

2. The Glass and Smith (1978) findings indicated a slightly stronger relationship between class size and achievement at the secondary level and no appreciable differences across school subjects, levels of student IQ, or several other classroom demographic variables.

3. The strongest objections to the work of Glass and Smith came from researchers at Educational Research Service (1980, 1986). In their estimation, the meta-analysis of class size/student achievement offered unjustified and even misleading conclusions. ERS argued that the central findings in the Glass and Smith meta-analysis were not based on 76 studies and 725 comparisons but on 14 "well-controlled" studies. In a rebuttal, Glass (1980) asserted the conclusions were based on about 75 studies and that the "magnitude of the relationship" was reflected in an analysis of the 14 best-controlled studies. Hedges and Stock (1983) reanalyzed the Glass and Smith data using improved statistical methods and concluded that, though sub-optimal methods previously used could have led to incorrect results, they did not. No closure on debate occurred as a result, in part because the reanalysis employed the same selection procedures. On this basis, Slavin (1984) argued the same erroneous conclusions were reached.

4. Robinson and Wittebols (1986) note that studies on the effects of class size on teaching practices indicate that "smaller classes tend to promote the use of desirable teaching practices; however, smaller classes do not guarantee that teachers will adapt their teaching practices to take advantage of the smaller classes."

5. As reported by Bossert and Barnett (1981), the general conclusion drawn from class size/academic achievement research at the Far West Laboratory is that: "Under certain conditions smaller classes are better. For example, one analysis concluded that classes must be reduced below 20 students before measurable effects are realized by students and teachers." The general conclusion reached by Hawley, Rosenholtz et al. (1984) was less equivocal: "Overall, the evidence supports the view that smaller classes enhance student achievement, especially when there are fewer than 15 students."

6. See articles by Hawkinson (1984) and Mueller (1985) on the Oak Park Plan originated at the Hatch School, Oak Park, Illinois, and adapted for use in Rochester, Minnesota, and in Fairfax County, Virginia, elementary schools. See also Project Star, a major elementary level longitudinal class size project currently in progress in Tennessee (Bain & Achilles, 1986).

7. Research in both areas is fairly limited though for different reasons. Relatively few studies of secondary teacher workload have been undertaken. However, one aspect of workload, teacher load (total number of students per day) has been studied in recent years by Hillocks (1986), Smith (1986), and others. The impact of teacher stress on student and teacher behavior has received some attention in the last fifteen years but most studies concentrate on identifying the presence of debilitating stress levels (Coates and Thoreson, 1976; Kyriacou and Sutcliffe, 1977; Phillips and Lee, 1980; Swick, and Hanley, 1980). Most recent studies have attempted to draw more precise conclusions about the actual, observable behavioral effects of negative teacher stress levels and have begun to examine stress as a organizational phenomenon. However, there are few empirical studies or organizational determinants of teacher stress. In fact, Bacharach, Bauer, and Conley (1986) point out few serious empirical investigations of any aspect of teacher stress exist since most teacher stress studies have been published in the popular press and have been largely anecdotal. Further, almost no studies deal with stress as an alterable organizational phenomenon.

The problems inherent in designing mechanisms aimed at reducing teacher stress are compounded by the failure of most researchers to recognize that elementary and secondary schools are very different organizations (Bacharach and Mitchell, 1982). Teacher stress research typically isolates a length-of-service variable rather than segregating the data by grade level. Very few studies focus directly or exclusively on secondary schools, although this is changing (cf. Pettegrew and Wolf, 1982; Bacharach, Bauer, and Conley, 1986). And as recently as 1985, Friesan and Williams found grade level failed to account for any significant variance (<1%) in overall job-related stress, while Bacharach et al. (1986) found that though mean stress values for elementary and secondary teachers were about the same, different sets of factors in their environments lead to teacher stress.

On the whole, the last fifty years of research on teacher stress has produced a pattern of results that indicates that many teachers operate under considerable stress in the classroom (Coates and Thoreson, 1976). Although teacher stress may not be higher than for professionals in other occupations, its negative impact on students is a serious and unfortunate possibility. Kaplan (1959) estimated teacher anxiety affected up to 200,000 teachers and their five million students. Kyriacou and Sutcliffe (1977), Dunham (1976), and Andrews (1977), reported a trend toward increased stress among teachers, a trend which in all likelihood has continued up to the present day despite some debate on the extent of high and moderate stress in the overall teaching population.

8. In a study by Schwab and Iwanicki (1982), role ambiguity accounted for 26% of the variance in teacher efficacy; and Denham and Michael (1981) found that less role ambiguity encouraged greater sense of teacher efficacy.

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